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WEEKLY TREATMENTS WITH A BURST-FIRING MAGNETIC FIELD ALTERS BEHAVIOR IN THE ELEVATED PLUS MAZE AFTER TWO SESSIONS[1]

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Summary.—In a split-litter design, rats were either injected with 15 mg/kg of clomipramine or saline from postnatal Days 8 through 21. Other rats from the same litters were not injected. When the rats were 90 days of age, the rats were tested once per week for five weeks in an elevated plus maze that contained two open arms (no walls) and two walled arms. Following each test, they were exposed (total of 4 exposures) for 30 min. to a burst-firing magnetic field (1 microTesla) that has been shown to reduce depression in human beings. After two treatments, the rats exposed to the burst-firing fields spent about half the amount of time in the open arms compared to the sham-field exposed rats. The interaction between adult treatment and whether the rats had received the antidepressant before weaning was not significant statistically. These results suggest that at least two weekly sessions may be required before significant changes in behavior occur after weekly 30-min. exposures to these potentially "therapeutic" magnetic fields.

Rats exposed to a weak (1 microTesla) specifically patterned magnetic field for 30 min. after training have shown significantly diminished fear conditioning (McKay, Persinger, & Koren, 2000). This field also potentiated the deficits in contextual fear learning from concurrent administration of agmatine (McKay & Persinger, 2003). We reasoned that sensitivity to other patterned magnetic fields long after administration of a drug such as clomipramine (Prathiba, Kumar, & Karanth, 2000), that permanently altered brain chemistry, would require several exposures. We selected a burst-firing pattern presented once per week because of its utility in treating depression in human patients (Baker-Price & Persinger, 2003).

To examine the validity of our hypothesis, rats in each of five litters from albino Wistar females were injected subcutaneously with a Hamilton microliter syringe with either 15 mg/kg (15 mg/cc) of clomipramine or saline from postnatal Days 8 through weaning (Day 21). Other rats from the same litters were not injected. After weaning, they were housed in same-sex cages until about 90 days of age. Nine rats from each of the three postnatal conditions (drug, saline, not injected) were tested once per week for 5 min. on the same day of the week for five weeks in an elevated plus maze. Equal numbers of rats from each condition were tested Monday through Friday.

The elevated plus maze had four runways positioned at right angles; 50-cm high walls surrounded the arms of one axis, while the orthogonal arms were exposed to open space. The time spent in the middle of the maze, within the closed arms, and within the open arms was recorded for each rat during its 5-min. test once per week. Within 5 min. after the testing in the maze, each rat was placed for 30 min. in a plastic cube cage (1700 cc). Three pairs of solenoids in each plane delivered the burst-firing field. It was presented for 0.5 sec. to each pair of

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solenoids and then to all solenoids simultaneously (McKay, Persinger, & Koren, 2000). The burst-firing magnetic field, whose intensity within the volume of the chamber was about 1 microT, was presented once every 4 sec. Half of the rats from each postnatal condition received the field while the other half did not.

A four-way analysis of variance with one level repeated (weeks) and three between-subject levels (sex, postnatal treatment, adult magnetic field treatment) for the square root transformation of the time spent in the open arms showed a statistically significant interaction ($F_{4,60} = 2.74$, $p = .04$; $\eta^2 = .16$) between adult treatment and weeks of exposure. The only other statistically significant effects were differences in durations spent within the open arms per week ($F_{4,60} = 14.34$, $p < .001$; $\eta^2 = .49$). The predicted interaction between postnatal treatment weeks of the adult magnetic field treatment was not significant statistically ($F_{8,60} = .27$, $p > .05$).

The means for the square root of the amount of time in minutes spent in the open arms for the five weeks (first week was baseline, before magnetic field treatment) for the sham-exposed rats were 1.4, .9, .9, .9, and .3, respectively. These values for rats exposed to the burst-firing field were 1.4, 0.7, 0.4, 0.4, and 0.5, respectively. All standard errors of the mean were about 0.1.

These results did not support our hypothesis that early exposures to this antidepressant compound increased the sensitivity of the rats' maze behavior to this particular pattern of magnetic field stimulation. However, the results clearly suggest that at least *two* weekly sessions may be required before any significant behavioral effects from 30-min. exposures to these "therapeutic" treatments are evident.

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